A NEGLECTED FACTOR IN RACE DEVELOPMENT

By Ellsworth Huntington, Ph.D.

Race development is the culminating phase of organic evolution. It differs from the evolution of plants and animals because it depends not only upon physical conditions such as the quest for food, the reproduction of the species, and the preservation of life, but upon economic, mental, moral, social and other conditions of a higher order. Yet the two sets of conditions are so closely allied that anything which influences the first is bound to influence the second. Given two persons of equal mental power and character, but one sickly and the other vigorous, there can be no question as to which will achieve more. In the same way hard economic conditions such as those of Scotland may not seriously retard a race blessed with great strength and mental vigor, but if the race is weakened by physical hardship or disease, or if the conditions become so severe that starvation is imminent or there is constant danger of death at the hands of relentless enemies, even the sturdiest race cannot make progress.

In the study of organic evolution there is a growing tendency to believe that variations in temperature, humidity, light, electrical tension and other climatic elements are even more important than was formerly supposed. For example, at the Desert Laboratory of the Carnegie Institution of Washington the experiments of MacDougal upon plants and of Tower upon insects seem to show that climatic variations not only exercise a powerful selective action upon mutations which arise from other causes, but are themselves sometimes responsible for mutations which may result in new and permanent species. Geologists under the lead of such men as Chamberlin and Penck have concluded that for millions of years changes of climate have been taking place on a scale far larger than was deemed

possible a generation ago. There has been not merely one glacial period, but many. These appear to have been divided into numerous epochs which in turn were subdivided into stages each representing a climatic oscillation from one extreme to another. Osborne, Schuchert, Merriam and others have shown the dominating importance of these changes in the evolution of all types of life. In a recent paper on "Climate and Evolution" Matthew has crystallized the growing trend of geological opinion, and has shown that climatic complexity is apparently sufficient to account for a large part of the more marked features of the evolution of the vertebrates, the only animals with which he deals. Contrary to the old ideas geologists are being forced to the conclusion that the continents have been relatively stable throughout geological history. They have of course varied greatly in size and shape, but this has been due apparently to emergences or submersals of one or two thousand feet and not to the creation or subsidence of enormous land bridges across the deep ocean basins, such as were once supposed to have connected Africa with South America or India. Many of the effects formerly supposed to be due to the upheaval or disappearance of continents are now thought to be due to some other cause which has induced climatic variations so great that at some periods semi-tropical vegetation has been able to grow in Greenland, while at others vast sheets of ice have shrouded the land within thirty or forty degrees of the equator.

Such tremendous changes have had a potent effect upon the origin and migration of species. In themselves they may have caused mutations, although as to that we still need more light. Certainly they have caused the selection of some mutations for preservation while others were destroyed because unable to endure the changed conditions. When the climate changed in any given area the tendency appears to have been to drive existing forms away, for they were able to subsist only in the areas where the old kind of climate prevailed. In other words, if a given area changed from a well watered region to a desert, the animals that were not able to endure desert conditions would be

preserved only on the moister borders, while within the desert there would be preserved only those mutations that were adapted to aridity. Thus a new and more specialized type of life would arise in the desert, while the older, less specialized types would persist in the periphery.

The abundant and convincing facts presented by Matthew seem to show that this is what has happened throughout geological time. The interior of Eurasia appears to have been the great center of dispersal. In that region the geological record again and again shows the primitive types from which a given family has evolved. In later geological formations we find this same family more highly developed in the region of its origin, and tending to spread out to surrounding areas. Ultimately we find the highest type in the original center or in the regions surrounding it, while more and more primitive types are found in the peripheral areas. The lowest types are apt to occur in warm and relatively inaccessible regions such as tropical Australia, South America, and Africa. The highest types are located in relatively cool, dry regions. Central Asia appears to have been the main dispersal center because that continent is the largest and therefore the most subject to extreme climatic variations. The other continents have also been minor dispersal centers, especially the cool temperate parts of North and South America, and still more of Europe.

Matthew's summary illustrates the importance of climate in the evolution and migration of human races so well that what he has to say about man is here quoted at length.[1]

> All authorities are today agreed in placing the center of dispersal of the human race in Asia. Its more exact location may be differently interpreted, but the consensus of modern opinion would place it probably in or about the great plateau of central Asia. In this region, now barren and sparsely inhabited, are the remains of civilizations perhaps more ancient than any of which we have record. Immediately around its borders lie the regions of the earliest recorded civilizations—of Chaldea, Asia Minor and Egypt to the westward, of India to the south, of China to the east. From this region came the successive invasions which overflowed

[1] W. D. Matthew: "Climate and Evolution," Annals of the New York Academy of Sciences, vol. xxiv, 1915, pp. 209–213.

Europe in prehistoric, classical and mediaeval times, each tribe pressing on the borders of those beyond it and in its turn being pressed on from behind. The whole history of India is similar—of successive invasions pouring down from the north. In the Chinese Empire, the invasions come from the west. In North America, the course of migration was from Alaska, spreading fan-wise to the south and southeast and continuing down along the flanks of the Cordilleras to the farthest extremity of South America. Owing to the facilities for southward migration afforded by the great Cordilleran ranges, the most remote parts of the New World are the forests of Brazil and of northeast South America. In the northern continent, Florida is the most distant from the source of migration.

In Africa, the region north of the Sahara has been overrun by successively higher types from the east. The great desert was a barrier to southward migration, being pierced only by the narrow strip of the Nile valley, from whose head spread out the successive populations of central and southern Africa. The main trend of migration followed the eastern highlands, the valleys of the Niger and Congo being more remote.

In the East Indies, the succession of great islands to the southeast, perhaps more connected formerly than now, formed stepping stones of migration to the distant continent of Australia.

The lowest and most primitive races of men are to be found in Australasia, in the remoter districts of southern India and Ceylon, in the Andaman Islands, in southwest and west central Africa and, as far as the New World is concerned, in northern Brazil. These are the regions most remote, so far as practicable travel-routes are concerned, from Central Asia. A century ago, the present habitat of primitive races was taken to be approximately the primeval home of man. With our present understanding of the conditions and causes of migration, a theory more in accord with tradition and history is generally accepted, and the dispersal center of man is regarded as situated in central or southern Asia. The influence of the old opinion is perhaps seen in the tendency to place this region south of the great Himalayan ridge and in tropical or semi-tropical climate.

This last assumption—that man is primarily adapted to a tropical climate—is, I think, only partly true at best. Its general acceptance is perhaps due, among other reasons, to the supposed relation between loss of hair on the body and the wearing of clothes, the first being regarded as an earlier specialization in an environment of tropical forests, the second as a secondary adaptation resulting from migration to a cold climate. But here, it seems to me, we are putting the cart before the horse. We may more reasonably regard the loss of hair in the human species as a result of wearing clothes and conditioned by this habit, rather than attribute it to any climate conditions. This view is supported by several points in which the loss of hair in man is differ-

entiated from the partial or complete loss of hair common in tropical animals, the following two being most clearly significant.

1. It is accompanied by an exceptional and progressive delicacy of skin, quite unsuited to travel in tropical forests. I do not know of any thin-haired or hairless tropical animal whose skin is not more or less thickened for protection against chafing, the attacks of insects, etc.

2. The loss is most complete on the back and abdomen. The arms and the legs and, in the male, the chest, retain hair much more persistently. This is just what would naturally happen if the loss of hair were due to the wearing of clothes,—at first and for a long time, a skin thrown over the shoulders and tied around the waist. But if the loss of hair were conditioned by climate it should, as it invariably does among animals, disappear first on the under side of the body and the limbs and be retained longest on the back and shoulders.

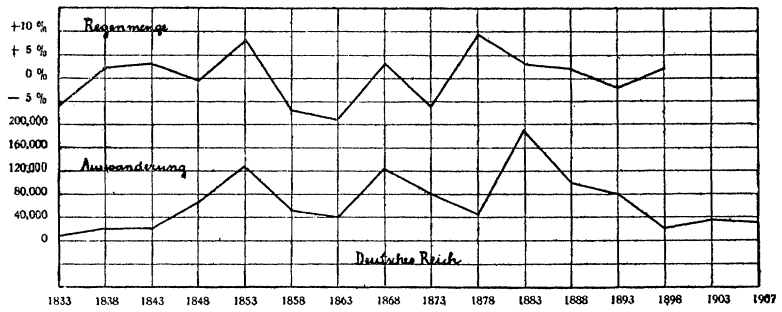
It will not be questioned that the higher races of man are adapted to a cool-temperate climate, and to an environment rather of open grassy plains than of dense moist forests. In such conditions they reach their highest physical, mental and social attainments. In the tropical and especially in the moist tropical environment, the physique is poor, the death rate is high, it is difficult to work vigorously or continuously, and especial and unusual precautions are necessary for protection from diseases and enemies against which no natural immunity exists and which are absent from the colder and drier environment.

This lack of adaptation to tropical climate is also true, although to a less degree, of the lower races of man. Although from prolonged residence in tropical climate they have acquired a partial immunity from the environment so unfavorable to the newcomer, yet it is by no means complete. The most thoroughly acclimatized race—the negro—reaches this highest physical development not in the great equatorial forests but in the drier and cooler highlands of eastern Africa; and when transported to the temperate United States, the West Coast negro yet finds the environment a more favorable one than that to which his ancestors have been endeavoring for thousands of years to accustom themselves. In tropical South America, the Indians, as Bates long ago remarked, seem very imperfectly acclimatized and suffer severely from the hot moist weather; much more than the negroes, whose adaptation to tropical climate has been a much longer one.

In view of the data obtainable from historical record, from tradition, from the present geographical distribution of higher and lower races of men, from the physical and physiological adaptation of all and especially of the higher races, it seems fair to conclude that the center of dispersal of mankind in prehistoric times was central Asia north of the great Himalayan ranges, and that when by progressive aridity that region became desert it was

transferred to the regions bordering it to the east, south and west. We may further assume that the environment in which man primarily evolved was not a moist or tropical climate, but a temperate and more or less arid one, progressively cold and dry during the course of his evolution. In this region and under these conditions, the race first attained a dominance which enabled it to spread out in successive waves of migration to the most remote parts of the earth.

The importance of climatic variations is not limited to the great movements of pre-historic times. It applies to our own day. Brückner, one of the chief European authorities on climate, has shown that there is an unmistakable agreement between the emigration from Great Britain and Germany on the one hand and the rainfall of



those countries on the other. The conditions for Germany are summed up in the accompanying diagram, where the upper curve shows variations in rainfall according to 5-year periods, while the lower shows the number of emigrants. In Germany wet years are unfavorable, for the crops are apt to be poor. Therefore people are discontented and want to get away to a new country. Brückner's description of what has happened in Ireland well illustrates the matter:[2]

The European region which has been most affected by emigration to America is Ireland. It is well known that through emigration the population of this country has been reduced by

[2] Eduard Brückner: Klimaschwankungen und Völkerwanderungen im XIX Jahrhundert, Internationale Wochenschrift fur Wissenschaft, Kunst und Tecknik, 5 March, 1910.

half. In 1841 there were 8,200,000 people, and in 1907 only 4,400,000. The bad social conditions which have given rise to the emigration are clear: the land is possessed by a few absentee landlords, who lease it to numerous tenants. The tenants pay their hard earned shillings only with great effort. The rapid emigration from Ireland began in 1846, after the population in 1845 had reached its maximum of 8,300,000. Damp years caused bad potato harvests; hunger and sickness carried off great numbers. Much more important in its effect on the density of population was the emigration. By 1851 the population was reduced to 6,600,000, and had thus lost 1,630,000 or 20 per cent.

During the succeeding dry period of the second half of the fifties and during the sixties the population continued to decline, but at a much slower rate, as appears in the accompanying table.

Population of Ireland

DATE	POPULATION IN MILLIONS	DECREASE	
		Millions	Per cent
1841	8.2		
1851	6.6	*1.63*	*20*
1861	5.8	0.77	12
1871	5.4	0.39	7
1881	5.1	0.24	4
1891	4.7	*0.47*	*9*
1901	4.5	0.24	5
1907	4.4	(0.13)	(3)

The decrease from 1851 to 1861 being about 12 per cent, from 1861 to 1871 about 7 per cent, and from 1871 to 1881 about 4 per cent. In the second half of the seventies, however, and in the eighties a pronounced wet period and its consequent poor harvests caused a distinct increase of emigration. From 1881 to 1891 it rose to 9 per cent, only to fall again during the succeeding dry period. I might repeat that we are here concerned with a combination of circumstances which influence the emigration. The continual bad social conditions work, as it were, statically. But to them is added as an intermittent factor the influence of climatic changes; the moist times with their bad harvests make the social conditions worse, and thus increase the emigration.

Immigration is by no means the only economic factor that is strongly influenced by climatic cycles. As long ago as 1902 Clayton[3] showed that there is a close relation between financial panics and rainfall. Panics are of course

[3] H. H. Clayton: Influence of Rainfall on Commerce and Politics, Popular Science Monthly, vol. 60, 1902.

due in large measure to defective banking systems, an inflexible currency, overproduction, and other strictly economic causes. Yet these causes remain comparatively harmless until unfavorable conditions of rainfall cause poor crops. Each of the four great panics of 1837, 1858, 1873, and 1893 was immediately preceded or accompanied by a period of deficient rainfall and scanty crops in the part of the United States where most of the people live. During the past year Moore,[4] under the apparent impression that he has discovered a new economic law, has carried the matter much farther. He presents some striking curves showing the average yield of the chief crops per acre throughout the country from 1871 to 1905. The variations in the curve depend entirely on climatic conditions, for due allowance is made for the improvement in agricultural methods. He compares this curve with two similar curves, one showing the price of pig iron, "the barometer of trade," and the other showing the trend of general prices. Both curves have been corrected for the depreciation in the value of gold. As thus corrected they unquestionably follow the variations in the productivity of the fields, and hence depend upon cycles of rainfall. The rise or fall in the price of pig iron lags about a year and a half behind fluctuations in the crops; and general prices lag nearly four years. When the crops are abundant the farmers have perhaps a billion dollars more spending money than in bad years. Hence the great agricultural states buy manufactured goods in large quantities, business is flourishing, and the demand for all sorts of commodities increases so that the price goes up. When the farmers cannot buy much, the factories begin to stop putting in new machinery, railroads cease new construction, and hence the demand for pig iron is diminished and the price begins to drop. Soon the demand along other lines decreases, other prices drop, factories close down in whole or in part, and hard times are upon us. Then a bad financial system, or some other economic mistake is able to cause a panic. Moore's curves

[4] H. L. Moore: *Economic Cycles: Their Law and Cause;* N. Y. 1914.

leave little doubt, however, that the primary source of the trouble is found in the varying conditions of rain and sun.

Between the great climatic changes of geological times discussed by Matthew and the little changes of our own times discussed by Brückner lies the period covered by history. Elsewhere I have set forth the hypothesis of "pulsatory" climatic changes during the last 3000 years or more.[5] The gist of the matter is that the climate of the earth seems to be highly unstable. Not only are there small cycles such as those pointed out by Brückner, and large ones causing glacial periods, but intermediate ones with a length of several hundred or a thousand years. The climate tends first toward one extreme and then toward an other, although the tendency in different parts of the world is not necessarily the same. When California becomes dry, Yucatan becomes wet, and so on. In general the oscillations appear to have been of greater magnitude as one goes back toward the beginnings of history. Able geographers still dispute this view, yet the number who support it has become so large that it appears to be at least a safe working hypothesis. Therefore in a recent volume I have attempted to show how it appears to be related to the distribution and development of civilization.[6]

The conclusions set forth in that volume are closely in harmony with those of Brückner and Matthew, and might appropriately be summarized here. It will be better, however, to avoid repetition by setting forth certain facts which have recently been presented by Pettersson, the veteran director of the Swedish Hydrographic-Biological Commission.[7] A large body of evidence indicates that in the middle of the fourteenth century the climate of the world made a brief swing toward the conditions that prevailed during the glacial period. Not that anything like the

[5] Ellsworth Huntington: *The Pulse of Asia*, 1907; *Palestine and its Transformation*, 1911; and *The Climatic Factor*, 1914.

[6] Ellsworth Huntington: *Civilization and Climate;* Yale University Press, 1915.

[7] O. Pettersson: "Climatic Variations in historic and prehistoric times," Svenska Hydrografisk—Biologiska Kommissioneus Skrifter. Heft. V; Göteborg, 1914.

glacial severity was attained, but the change was in that direction. Brückner has shown that after standing at a very low level because of an arid period in the twelfth and early thirteenth centuries the Caspian Sea rose rapidly, and in the fourteenth reached a level much above that of the present day, a condition which would only be possible with an increased rainfall. My own researches show that the same thing occurred two thousand miles farther east in Chinese Turkestan. Norlind has shown conclusively that at this time the regions around the North Sea were subject to much more severe floods and storms than either before or since. The winters were so cold that the sea froze to an unprecedented degree, and horses as well as men were able to cross the Baltic Sea from Germany to Sweden. In America the giant sequoia trees of California suddenly began to grow with unusual rapidity, a condition which can scarcely have been due to anything except increased rainfall or at least to a different distribution of the rainfall during the seasons so that the long summer drought was shortened. Far away in Mexico the lakes around Mexico City expanded, only to fall during later centuries. All these lines of evidence, as well as many others which cannot here be discussed, point to a period of peculiar climatic intensity which reached its maximum about the middle of the fourteenth century.

In a recent publication on "Climatic variations in historic and prehistoric time" Pettersson, gives a most interesting account of the effect of this period on Greenland, Iceland, and Scandinavia. As an example of the way in which even a brief epoch of climatic severity may alter the course of history his results are so valuable that the rest of this article will be devoted mainly to their consideration. The discovery of America was undeniably one of the world's great events. If the Norsemen had preserved their contact with the New World unbroken from the time of its discovery in the tenth century there can be little doubt that with the advance of knowledge at the end of the Middle Ages their discovery would have become known all over Europe long before the days of Columbus, and ships

in large numbers would have sought the New World by the northern route. If that had happened Canada would probably have been the first part of continental America to be settled by Europeans. Both that country and the United States would presumably have been much more Scandinavian than is now the case. Spain would probably have played a less important rôle than has actually fallen to her. Whether these suppositions are right or wrong, the general fact remains unshaken: America today would be a different place if the Norsemen had not ceased to visit America early in the fifteenth century and finally forgotten it for all practical purposes.

Pettersson shows, convincingly as it seems to me, that the climatic pulsation to which we have referred prevented the Norsemen from reaching Greenland and thus cut them off from America. The proof is briefly as follows: Today the North Atlantic Ocean northeast of Iceland is full of drift ice much of the time. The border of the ice varies from season to season, but in general it extends westward from Iceland not far from the Arctic Circle and then follows the coast of Greenland southward to Cape Farewell at the southern tip and around to the western side for fifty miles or more. Except under exceptional circumstances a ship cannot approach the coast until well northward on the comparatively ice-free west coast. In the old Sagas, however, nothing is said of ice in this region. The route from Iceland to Greenland is carefully described. In the earliest times it went from Iceland a trifle north of west so as to approach the coast of Greenland after as short an ocean passage as possible. Then it went down the coast in a region where approach is now practically impossible because of the ice. At that time this coast was icy close to the shore, but there is no sign that navigation was rendered difficult as is now the case. Today no boat would think of keeping close inland. Finally the old route went *north* of the island on which Cape Farewell is located, although the narrow channel between the island and the mainland is now so blocked with ice that no modern vessel has ever penetrated it. By the thirteenth century, however,

there appears to have been a change. In the Kungaspegel or "Kings' Mirror" written at that time navigators are warned not to make the east coast too soon on account of ice, but no new route is recommended in the neighborhood of Cape Farewell or elsewhere. Finally, however, at the end of the fourteenth century, nearly 150 years after the Kungaspegel, the old sailing route was abandoned, and ships from Iceland sailed directly southwest to avoid the ice.

Turning to the inhabitants themselves Pettersson's account shows that their experiences point to the same change of climate as does the ice. In the tenth and eleventh centuries a strong emigration took place to Iceland and Greenland. It was to the interest of Eric the Red to encourage this. The year after his return from his flight to the west, that is in 986 A.D., a Viking fleet numbering some 25 ships sailed with colonists for Greenland. They carried cattle, building materials and household goods. Probably each ship carried 30 or 40 human beings so that the total number may have been 800–900. In course of time the settlement of Österbygden numbered 190 farms, 12 churches, 2 monasteries, and one bishopric. The less important settlement of Vesterbygden numbered 90 farms.

Speaking of the statements of the Sagas as to the ancient fertility of Greenland which have been doubted by certain authors Pettersson reminds us,[8] "that the Österbygd of Greenland is in the same latitude as the Hardanger and the Sognefiords of Norway, and that in the interior of these fiords there are farms situated immediately below the greatest glacier in Europe, the Josteldalsbrae. Yet they ripen excellent apples, cherries, etc. Even now the fertility of the Österbygd surprises those who visit Greenland, as Nordenskiold among others affirms. Before the ice blocked the coast the climate of these fiords must have resembled that of the Norwegian fiords. We must not, however, conclude that the similarity of climate would extend to the vegetal and animal life, for this is a question of migration. . . . . There is no ground for supposing the Norsemen

[8] Loc. cit., p. 12ff.

to have cultivated forest, but there is every reason to expect the monks to have imported fruit-trees and cultivated gardens as they did everywhere they went. There is no incredibility in the statement of Ivar Bårdsson [one of the old chroniclers] that under the high mountains trees grew which bore big apples good to eat. When we are told of the inhabitants of Iceland that they lived in winter on fruit of trees they had cultivated in summer, we must remember that those early inhabitants were monks and anchorites who from their homes in Ireland were well acquainted with gardening. Also the climate of Iceland in the seventh century may have been much more temperate when the frequent blocking of the coast by drift-ice had not yet commenced. [Such blocking did not begin till the thirteenth century. It reached a maximum in the fourteenth] Still fruit-growing in Iceland must always have been more difficult than in Greenland because of the more exposed position of the former island."

As to the cultivation of grain, probably Greenland was never well adapted for corn-growing though in certain places, as stated by Ivar Bårdsson, excellent wheat might very well have been grown. Already in Eric Röde's Saga the want of corn to make malt is mentioned, and the Kongaspegel, though admitting that grain was grown in Greenland, adds that its cultivation was not general and that the majority of colonists depend on import to supply them with grain and building material.

With regard to pasture, however, Greenland seems to have been quite as well off as any of the northern countries. Cattle-raising and fishing appear to have procured a good living for the colonists until the ice made the fishing grounds barren and shortened the period of vegetation so that the cattle had to be fed indoors most of the year. At present the whole stock of cattle in Greenland probably does not amount to a hundred animals although wealth is increasing and the population is at least as numerous as in the time of the colonies. In 1780 there was, according to Crantz, probably no single representative of the genus Bos taurus.

Commander Holm, who spent several years in Julianehaab's district and visited more than a hundred ruins of old Norse dwellings, says:

"In the neighborhood of all the larger groups of ruins there has been ample fodder during the summer to feed large flocks of sheep and cattle. How these herds were fed in winter is difficult to say unless we assume the climate in those days to have been milder, so that the cattle could graze in the open field a greater

part of the year than now. The ancient records state that the icedrift along the coast has increased in historic time and this assumption seems indeed necessary in order to explain how the ancients could navigate the inlets and fiords of the District, nor can it be denied that the ice which now encloses this part of the country greatly enhances the severity of the climate."

Another effect of the climatic deterioration is that the inland ice appears to have advanced for a considerable time, so that certain groups of ruins have been buried beneath it. Ruins of ancient dwellings were discovered by Captain Bruun, curiously wedged in between glaciers and rivers so as to be very difficult of access. That ruins of farm houses are found in such places nowadays may be explained [as meaning] that the glacier has advanced after they were built. In the interior of Ilua Captain Holm found 4 groups of ruins just below the glacier. The Eskimos told him that beneath that glacier was buried a village and a churchyard. As many of the villages and churches enumerated in the ancient Chorography have not been retrieved it may be that part of the old Österbygd has been covered by the advancing inland ice in the course of the last five centuries.

. . . . At the end of the thirteenth and the beginning of the fourteenth century the European civilization in Greenland was wiped out by an invasion of the aboriginal population. The colonists in the Vesterbygd were driven from their homes and probably migrated to America leaving behind their cattle in the fields. So they were found by Ivar Bardsson steward to the Bishop of Gardar in his official journey thither in 1342. The colonists of Osterbygd succumbed after a hard struggle some time after 1418. Their houses and churches were destroyed by fire as the ruins still testify. According to Eskimo tradition the last of the colonists fled to the seacoast and there succumbed. After the destruction of the colonies the Eskimo appear to have taken up piracy, attacking and sinking the English, Portugese and Dutch whalers that visited the south coast.

The Eskimo invasion must not be regarded as a common raid. It was the transmigration of a people, and like other big movements of this kind [was] impelled by altered conditions of nature, in this case the alterations of climate caused by [or which caused?] the advance of the ice. For their hunting and fishing the Eskimos requires an at least partially open arctic sea. The seal, their principal prey, cannot live where the surface of the sea is entirely frozen over. The cause of the favorable conditions in the Viking-age was, according to my hypothesis, that the ice then melted at a higher latitude in the arctic seas.

The Eskimos then lived further north in Greenland and North America. When the climate deteriorated and the sea which gave them their living was closed by ice the Eskimos had to find a more suitable neighborhood. This they found in the land colonized by the Norsemen whom they attacked and finally anihilated. The description in the old records of the cruelties of the Eskimos

Nansen simply rejects because the disposition of this people for the two centuries past since the time of Hans Egede has been noted for its mildness and gentleness. A glance at the Olai Magni map [where two men stand on Greenland with spears lowered for action] shows that they were regarded in quite another light in the 15th and 16th centuries. La Peyrère in his Relation de Groenland (1647) characterizes them as being treacherous and wild. . . . The survivors of Hudson's third expedition 1610–1612 were treacherously assaulted and murdered on an island by the Eskimos. In the reign of Christian I they were regarded as pirates who stood up to foreign fishing vessels and sunk them.

Taken in connection with many facts of similar import in respect to Iceland Pettersson's statements as to a change of climate in Greenland and as to its effects seem convincing. Their probability is greatly increased by the correspondence between their date and that of related phenomena in North America and Asia. To deal only with the more remote of the two continents, the dry or warm period in the twelfth century which saw the height of Greenland's prosperity under the Norsemen was a period of drought and distress in Asia. In the beginning of the thirteenth century it culminated in the series of great invasions which are associated with the name of Jenghis Khan. Like the later movements of the Eskimos these were no ordinary wars, but great movements of a stricken people from the homes where the climate was making life unbearable for a large population. All that was wild and fierce in the nomads of Asia came to the surface. If any one doubts the possibility of such a transformation of character as that which Pettersson describes among the Eskimos, let him live for a while among the Turkamons. I have seen them in a time of prosperity when they were happy, industrious, and contented, a pleasant people with whom to dwell. They had no word of complaint for the Russian government which had conquered them only thirty years before and had completely changed their old customs. I have also seen them when a dire plague of locusts had scoured the land as clean as a billiard table. They gathered sullenly in groups. There was no laughter, no pleasant greetings; only requests for work, or sullen silence and suspicion. Gathering by

threes and fours they talked of their hardships and of the unjust government to which with utter lack of logic they ascribed their woes. Let people suffer in that way for a few years and the mildest, most gentle race upon earth will become desperate and truculent.

Let us finish our survey of the effects of the climate of the Middle Ages by one more quotation from Pettersson:[9]

> On examining the historic [data] from the last centuries of the Middle Ages, Dr. Bull of Christiania has come to the conclusion that the decay of the Norwegian kingdom was not so much a consequence of the political conditions at that time, as of the frequent failures of the harvest so that corn for bread had to be imported from Lübeck, Rostock, Wismar and so forth. The Hansa Union undertook the importation and obtained political power by its economic influence. The Norwegian land-owners were forced to lower their rents. The population decreased and became impoverished. The revenue sank 60–70 per cent. Even the income from Church property decreased. In 1367 corn was imported from Lübeck to a value of ½ million kroner. The trade balance inclined to the disadvantage of Norway whose sole article of export at that time was dried fish. [The production of fish increased enormously in the Baltic regions off south Sweden because of the same changes which were influencing the lands, but this did not benefit Norway.] Dr. Bull draws a comparison with the conditions described in the Sagas when Nordland [at the Arctic Circle] produced enough corn to feed the inhabitants of the country. At the time of Asbjörn Selsbane the chieftains in Trondhenäs [still farther north in latitude 69°] grew so much corn that they did not need to go southward to buy corn unless three successive years of dearth had occurred. The province of Throndheim exported wheat to Iceland and so forth. Probably the turbulent political state of Scandinavia at the end of the Middle Ages was in a great measure due to unfavorable climatic conditions, which lowered the standard of life, and not entirely to misgovernment and political strife as has hitherto been taken for granted.

One more important aspect of the matter remains to be pointed out. The failure of the Norsemen to perpetuate their settlements in America was not due merely to the hardships of the colonists nor to the fierce invasion of the Eskimos from the north. It was due also to the fact that Norway itself was retrograding at the time when its support was most needed by the Greenlanders. When the

[9] Loc. cit., p. 22.

Norwegians were suffering from increasing proverty, when they were falling a prey to foreign exploiters because of their poverty, and when they were in the midst of political and social turmoil they could not help their colonists as they had been able to in the earlier days. Had their prosperity remained, they probably would have succored the colonists and might even have planted new colonies on the main land of North America when the Eskimos made trouble in Greenland. It is useless to speculate what might have happened, but the main point is evident. The change of climate which culminated in the fourteenth century was more than local in its effects. Hence the various countries suffered not only from the direct effects upon themselves but from the snapping of the cords which held one to another and thus strengthened both. Thus the northern parts of both hemispheres suffered a two-fold loss while regions farther to the south were benefited and were growing strong.

It would be interesting to go on and trace the effects of the climatic pulsation of the fourteenth century in all parts of the world. Since some regions were harmed and others helped, there must have been intermediate regions which were not influenced in either direction except that their intercourse with the favored regions presumably increased while with the regions that suffered harm it decreased. How great the total effects may have been it is impossible to say. In individual cases they must have ranged all the way from almost nothing up to such overwhelming disasters as the overthrow of European civilization in Greenland and the cutting off of the New World from the Old.

From whatever standpoint we view the question changes in the climatic elements seem to be of profound importance in modifying human actions and character. Just as the weather day by day makes us gay or cross, energetic or lazy; or as the character of the seasons makes millions of farmers, merchants and manufacturers prosperous and contented or poor and unhappy, so the larger changes of the past seem to have brought wealth and progress to whole

nations and races at some times, while at others they have overturned civilization and driven men back to savagery. Not only our own daily observations, but investigations of economics, history, ethnology and geology all point in the same direction. Doubtless our interpretations are far from perfect, yet does there not remain a body of evidence which makes it of the highest importance carefully to investigate the effect of climate upon history and race development?